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FLOOD INSURANCE STUDY

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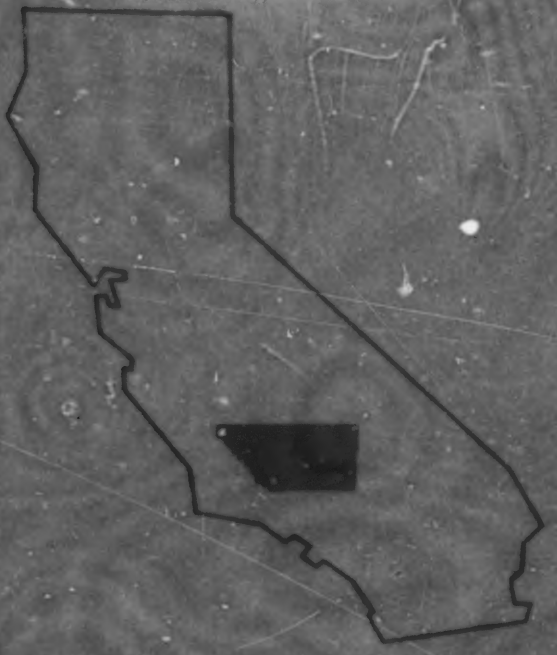

KERN COUNTY, CALIFORNIA
UNINCORPORATED AREAS

VOLUME 1 OF 3

SEPTEMBER 29, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 060075

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Kern County, California, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Boyle Engineering Corporation, for the Federal Emergency Management Agency (FEMA), under Contract No. H-4709. This study was completed in March 1984.

1.3 Coordination

An initial coordination meeting attended by representatives of FEMA, Kern County, and the study contractor was held in March 1978. Flooding sources requiring detailed and approximate analyses were identified at this meeting. Technical coordination meetings were held between representatives of FEMA and the study contractor throughout the study.

Unpublished information was requested from: the National Weather Service; National Climatic Center; National Technical Information Service; U.S. Army Corps of Engineers (COE); U.S. Geological Survey (USGS); U.S. Soil Conservation Service (SCS); U.S. Forest Service; U.S. Naval Weapons Center at China Lake; Sequoia National Forest; Agricultural Stabilization and Conservation Service; California

Departments of Water Resources, Finance, and Transportation; Kern County Water Agency (KCWA), and Kern County Planning Department, Public Works Department, Road Department, Farm and Home Advisor, and Fire Department; Southern Pacific Railroad; Atchison, Topeka & Santa Fe Railroad (AT&SF); Pacific Gas and Electric Company; city governments of Ridgecrest, Tehachapi, California City, Bakersfield, Delano, Taft, and Arvin; Bakersfield Department of Public Works; Lamont Public Utility District; Tehachapi-Cummings County Water District; and private firms, including Great Western Cities, Inc., McIntire & Quiros, Lusich Patrick Henderson Mueller & Associates, Inc., and Mason, Vancuren and Wachob.

In addition, a notice explaining the purpose of the study was published in 11 Kern County newspapers during November and December 1978. The notice invited interested persons to furnish relevant facts or technical data about local flood hazards.

The final coordination meeting was held on March 13, 1984, with representatives from FEMA, Boyle Engineering Corporation, Kern County Planning and Public Works Departments, and KCWA. No major problems with this study were identified at that meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Kern County, California. The area of study is shown on the Regional Map (Figure 1).

Areas not included in this study are the incorporated Cities of Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco. Also not included are the China Lake Naval Weapons Center, Edwards Air Force Base, Kern National Wildlife Refuge, Los Padres National Forest, Naval Petroleum Reserve No. 1, and Naval Petroleum Reserve No. 2.

The county has been divided into four regions in this report to facilitate discussion of the hydrologic and hydraulic analyses (Section 3.0). Figure 1 shows the boundaries of the four regions.

Flooding sources studied by detailed methods are listed in Table 1.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1990.

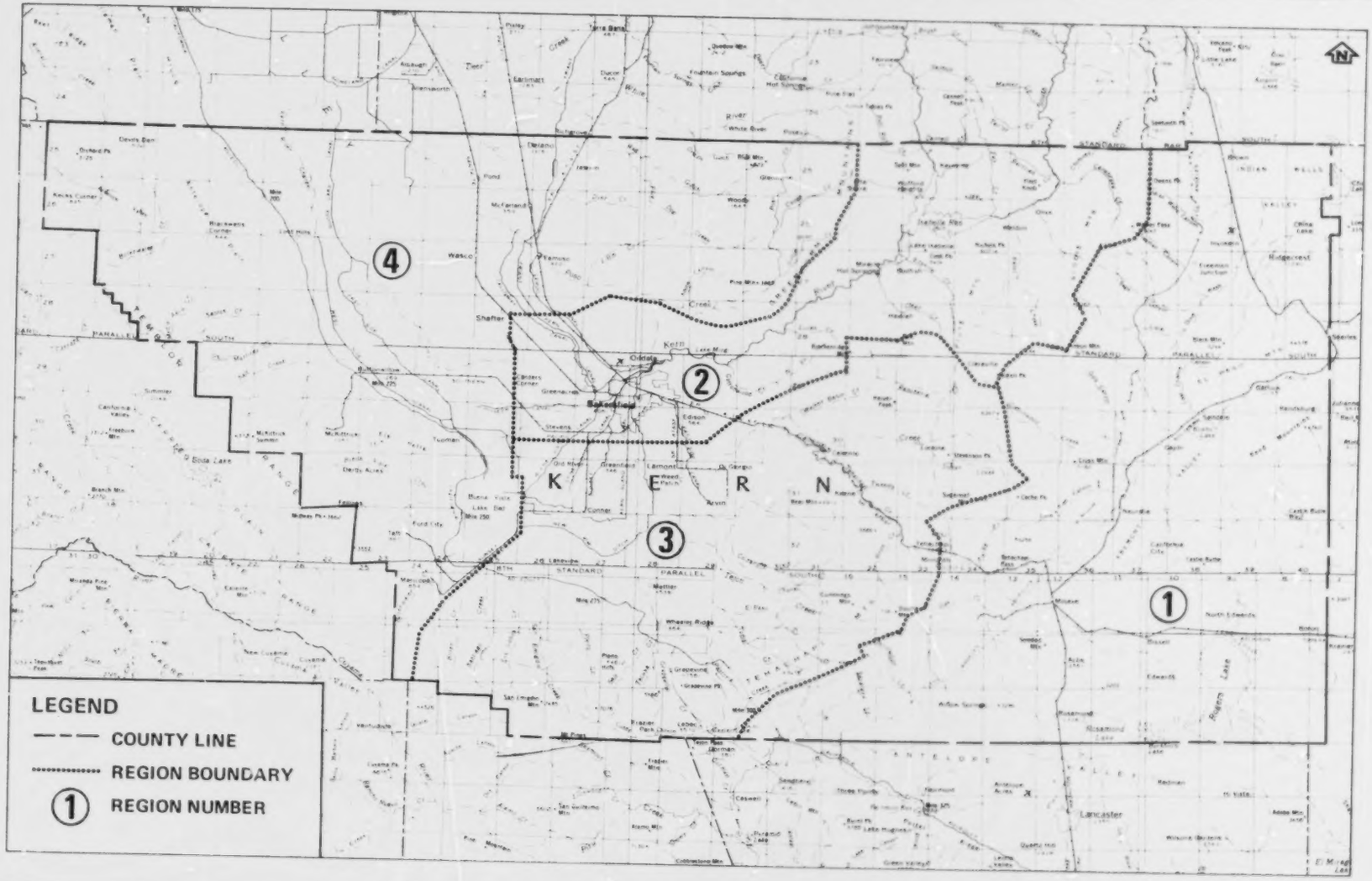

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

16 0 16 32 48 MILES

REGIONAL MAP

Table 1. Detailed-Study Flooding Sources

Flooding Source	Location
Region 1	
Boron Avenue Creek	Confluence with Twenty Mule Team Creek upstream to Boron Avenue
Calvert Wash	Confluence with El Paso Wash to Interstate Highway 395
Claymine Wash	State Highway 58 to a point upstream approximately 1.2 miles
College Heights Wash	Between the City of Ridgecrest and the county boundary
East China Lakes Wash	Between the City of Ridgecrest and the county boundary
Jawbone Canyon Wash	Munsey Road to approximately 4,000 feet upstream of Neuralia Road
Little Dixie Wash	Interstate Highway 395 to Ridgecrest-Inyokern Boulevard
North El Paso Wash	Interstate Highway 395 to confluence with Calvert Wash
North Ridgecrest Wash	Eastern corporate limit of Ridgecrest to West Bowman Road
South El Paso Wash	Approximately 1,200 feet north of West Bowman Road to Ridgecrest-Inyokern Boulevard
South Ridgecrest Wash	Confluence with North Ridgecrest Wash to West Bowman Road
Twenty Mule Team Creek	County boundary to the downstream side of Gephart Road
Grapevine Canyon Creek, Short Canyon Creek, Indian Wells Canyon Creek	East of China Lake Naval Weapons Center and west of Los Angeles Aqueduct

Table 1. Detailed-Study Flooding Sources (Cont'd)

Flooding Source	Location
Region 2	
Breckenridge	Between Breckenridge Road and Southern Pacific Railroad
Doyle Street	Beardsley Canal to Seven Sisters Road
Erskine Creek	State Highway 178 to Erskine Creek Road
Hawthorne Boulevard	North of State Highway 178, west of Haley Street, and east of Loma Linda Drive
Kelso Creek	State Highway 178 to Kelso Valley Road
Kern River at Kernville	In vicinity of Kernville
Kern River at Bakersfield	1 mile downstream of Sequoia National Forest Boundary to 1.1 miles north of Southern Pacific Railroad
South Fork Kern River	Vicinity of Bella Vista to a point approximately 10 miles upstream
Ward Street	Near Bakersfield, Southern Pacific Railroad upstream to James Road
Region 3	
Antelope Creek	City of Tehachapi western corporate limits to approximately 200 feet north of confluence with Water Canyon Creek
Shallow Flooding Near Bakersfield	Southernmost area of the City of Bakersfield
Blackburn Creek	Along State Highway 58 from confluence with Antelope Creek to Tehachapi western corporate limits
Caliente Creek	Along Southern Pacific Railroad near Caliente
Cuddy Creek	In the vicinity of Lake of the Woods to Castac Lake

Table 1. Detailed-Study Flooding Sources (Cont'd)

Flooding Source	Location
Ranger Station Creek	Confluence with Cuddy Creek to southern county boundary
Shallow Flooding Near Tehachapi	Highline Road to Alan Avenue
Upper Sycamore Creek	Approximately 2,000 feet downstream of Lower Valley Road to Cumberland Road
Region 4	
Blackwells Corner	South of intersection of State Highways 46 and 33
Shallow Flooding at McFarland	East of Frian-Kern Canal and west of State Highway 99
Poso Creek	Porterville Highway downstream to State Highway 99
Sandy Creek	Approximately 700 feet downstream of State Highway 33 to 1,000 feet south of Midoil Road
South Branch Poso Creek	Confluence with Poso Creek to State Highway 99

Flooding sources studied by approximate methods are as follows:

Region 1

Astoria Avenue
Cache Creek
Ditch at Mojave
West Claymine Road

Region 2

Cranebrake Creek
Evans Road
Johnson Canyon Creek
Lynch Canyon Creek
Mt. Mesa
Ranch Canyon Creek
Rancheria Creek
South Fork Kern River
Scodie Canyon Creek
Smith Canyon Creek
Tillie Creek
Walker Basin Creek

Region 3

Antelope Canyon Creek
Blackburn Canyon Creek
Brite Creek
Grapevine Creek
Mendiburn Canyon Creek
O'Neil Creek
Water Canyon Creek

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Boyle Engineering Corporation.

2.2 Community Description

Kern County lies at the southern end of the San Joaquin Valley, in southern California. The county is bordered on the west by San Luis Obispo and Santa Barbara Counties; on the south by Ventura and Los Angeles Counties, on the east by San Bernardino County; and on the north by Kings, Tulare, and Inyo Counties. Kern County covers 8,064 square miles and is California's third largest county. Elevations range from 205 feet to 8,775 feet.

The county can be divided into three distinct physiographic zones: valley, desert, and mountain. The valley portion, the western one-third of the county, is its population and agricultural

center. Valley crops make Kern County a leading agricultural producer among the nation's counties. The Mojave Desert covers the eastern one-quarter of the county. Major economic activities in the desert depend on military installations--Edwards Air Force Base and the China Lake Naval Weapons Center--and on mining. One of the world's largest borax deposits is located near Boron. The third zone in the county consists of a ring of foothills and mountains. The Temblor Range, part of the Coast Range, borders the western edge of Kern County. The Tehachapi Mountains separate the valley from the Los Angeles basin to the south. The Sierra Nevada range separates the valley from the desert to the east. The western hills contain a major source of petroleum; Kern County produces one-half of California's annual petroleum output. The Tehachapi and Sierra Nevada ranges contain a number of year-round and seasonal resorts and produce some commercial timber and minerals.

The vegetation and climate of Kern County vary among its three physiographic zones. Generally, the county is classified as desert or semiarid, with hot, dry summers and mild, humid winters. In most areas, 90 percent of the precipitation occurs from November through April (Reference 1).

In the valley, rainfall averages 3 to 7 inches annually. Maximum summer temperatures in Bakersfield average 101°F; there are approximately 110 days per year when temperatures are higher than 90°F. On the average, 16 days per year have temperatures below 32°F (Reference 1). The long growing season of 250 to 300 days allows growing a wide range of crops when irrigation is provided. Major agricultural products of the valley include grapes, cotton, cattle, potatoes, almonds, oranges, forage crops, spring and summer vegetables, and rose plants. Annual production of these commodities is valued at more than $15 million each (Reference 2). Before the coming of agriculture, the valley floor was covered by grassland. It was one of the most productive wildflower areas of the state.

Because of the topography, the climate of the mountain zone tends to be cooler and wetter than the other zones. The western hills, in the lee of the Coast Range, are semiarid and sparsely vegetated. In contrast, the windward sides of the Tehachapi and Sierra Nevada ranges receive as much as 40 inches of precipitation a year. An average of 30 inches of snow falls at higher elevations. However, most snow cover is intermittent during the winter because of occasional melting (Reference 1). The occurrence of thunderstorms and the potential for intense, local rainfall increase on approaching the Sierra Nevada range. Whereas the western edge of the valley experiences an average of one such storm each year, the number increases to 15 to 20 per year over the mountains. These occur with greatest frequency in the summer (Reference 1). Four plant communities occur in the mountain zone, depending on site characteristics: oak woodland, coniferous woodland, desert shrub, and grassland (Reference 3).

The desert zone lies in the lee of the Tehachapi and Sierra Nevada ranges. Precipitation averages 3 to 6 inches a year, but is extremely variable. Snowfall is infrequent, but may range from 1 to 4 inches when it occurs. Snow and winter rains result from North Pacific cyclonic storms. The remainder of the precipitation comes from intense, local thunderstorms and summer tropical storms. The natural vegetation is sparse and consists primarily of creosote and burroweed; Joshua trees occur in some locations.

Early settlement in Kern County was spurred by the discovery of gold in 1851. The initial population was centered in the mountain zone. When Kern County was organized in 1866, the first county seat was Havilah, located approximately 70 miles northeast of Bakersfield. The government center was transferred to Bakersfield in 1873, reflecting the gradual population shift to the valley (Reference 4).

In 1980, the population of Kern County was 403,089. This represents approximately a 22-percent increase from the 1970 population of 330,234 (Reference 5). The population is served by a number of major highways. Interstate Highway 5 and State Highway 99 are oriented along the north-south axis of the valley. State Highway 58 connects the valley to the Mojave Desert, and State Highway 14 and Interstate Highway 395 run east of the Sierra Nevada range. Maintained county roads exceed 3,362 miles. In addition, there are 10 county airports and 2 railroad lines.

Securing a reliable water supply has been a continuing problem for much of Kern County. Current need in the valley is partly met by supplies from surface-water impoundments, such as Lake Isabella on the Kern River, and from ground water pumping. Additional water must be imported by the Central Valley Project and the California Aqueduct. Because of the need for drainage and irrigation works, farms in the valley traditionally have been, and continue to be, large. Each farm averages 1,752 acres (Reference 2).

The only major river in the county is the Kern River, with an average annual runoff of 700,000 acre-feet (Reference 6). The Kern River is the chief flooding source in the Bakersfield area. Isabella Dam controls 2,074 square miles of the Kern River basin, but floodwaters can still arise from approximately 333 square miles of watershed downstream of the dam. Releases from Isabella Dam and natural runoff flow through a steep canyon for approximately 30 miles downstream of Isabella Reservoir, then flow southwesterly over the valley floor to Bakersfield. Twenty-one miles downstream of Bakersfield, the Kern River enters Buena Vista Lakebed, or flows to Tulare Lake via the Kern River Flood Canal. Flow can also be diverted to the California Aqueduct via the Kern River-California Aqueduct Interite, completed in 1977.

Many small streams also cause flooding problems in the valley when they discharge from steep canyons. These streams are confined and distinct in upland areas, but tend to spread out into a number of

poorly defined drainages on the valley floor. Flow is further disrupted by cultivation and urbanization. This type of flooding occurs at Caliente Creek (Region 3), Poso Creek, and Blackwells Corner, and in the vicinity of Taft (Region 4).

Similar problems occur in the desert area, where ephemeral streams flow across alluvial fans. Drainage channels are poorly defined and can shift from one flood event to the next. Streets, railroads, and other structures divert flows, and may increase flooding problems. Of the flooding sources in the Mojave Desert, only Jawbone Canyon Wash (Region 1) rises in the Sierra Nevada range. The washes affecting the Boron and Ridgecrest areas are defined by local drainage divides.

Another type of flooding occurs in the mountains, where streams flow through alluvial valleys. In these areas, flows peak quickly and have high velocities. Mountain flooding sources include Cuddy Creek, Upper Sycamore Creek, Antelope Creek, Blackburn Creek, and Caliente Creek in Region 3; and Erskine and Kelso Creeks in Region 2.

2.3 Principal Flood Problems

Flooding results from a variety of conditions in Kern County. Intense storms can cause high flood peaks that pass rapidly, but can leave severely damaged property in their wake. Spring snowmelt often results in high flows that have a longer period of runoff and a lower peak than rain floods. Overflow from poorly defined channels and inadequate culverts and drains can lead to shallow flooding, even from low-intensity rainfall.

Various areas in Kern County have suffered from numerous floods. Severe flooding occurred in November 1950, December 1966, January and February 1969, and September 1975. Localized flash flooding occurred in September 1976, and a large storm produced high flows on various streams in February 1978. A large storm in March 1983 in the mountains of the Caliente Creek watershed caused extensive flooding of the Caliente Creek area near the Cities of Arvin and Lamont.

A series of storms during November 1950 produced widespread flooding throughout the Sacramento and San Joaquin River basins in California, and the Truckee, Carson, and Walker River basins in California and Nevada. At many localities, these floods were the most destructive experienced over the 40- or 50-year period of record (Reference 1). Peak flow on the Kern River at the First Point gage (located 6 miles upstream of Bakersfield) was 36,000 cubic feet per second (cfs). This flow occurred 4 years before Isabella Dam was constructed, and would have a recurrence interval of approximately 670 years under current, regulated conditions. Bakersfield was saved from damage by intensive flood fighting; however, part of neighboring Oildale, the Fruitvale oilfield, and agricultural areas were flooded, and Gordon's Ferry Bridge was washed out. Approximately 37,000

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acres were flooded along the entire length of the Kern River, and flood damage totaled nearly $2 million (Reference 1). Some areas along Poso and Caliente Creeks were also flooded.

An intense 48-hour storm on December 4-6, 1966, caused severe flooding in a 60- by 100-mile area in the Sierra Nevada range northeast of Bakersfield. The Kern, Tule, and Kaweah River basins were affected. Damage was extensive in all headwater areas of these three stream systems. The road from Kernville upstream of Johnsondale along the Kern River was obliterated at the outside bank of many river bends, and the pavement was scoured away in other locations. Water-stage recorder structures and the measuring cableways on the Kern River at Kernville and South Fork Kern River near Onyx were destroyed by the flood (Reference 2). Further downstream, Isabella Dam minimized flood damage to the valley. Peak flow along the Kern River was 60,000 cfs, more than twice the previous maximum that occurred in November 1950 (Reference 2). The COE estimated that if Isabella Reservoir had not been in operation, flow on the Kern River at the First Point gage would have been approximately 80,000 cfs (Reference 3). Actual flow was nearly 9,300 cfs, which has a recurrence interval of approximately 80 years. Areas along Caliente Creek were also flooded, resulting in $625,800 in damage to urban and rural property.

Storms during January 18-22 and 24-27, 1969, produced heavy rainfall that caused extensive flooding in the San Joaquin Valley. Flows in the Kern River at Kernville were one-third of the record flows in 1966, but were the third or fourth highest of record (Reference 6). A storm that lasted from February 22 to 24 brought heavy rain in the southern and western portions of the San Joaquin Valley. Poso Creek near Oildale had a peak discharge of 6,600 cfs on February 24, 1969. This flow has a recurrence interval of approximately 22 years. Nearly 38,000 acres were inundated by this stream (Reference 4). On February 25, El Paso Wash, just downstream of Inyokern Road in Ridgecrest, had an estimated flood peak of 350 cfs (Reference 7). This flow has a recurrence interval of approximately 13 years.

Major flooding occurred in Kern County on September 9-10, 1975. High-intensity thunderstorms passed over the northeastern part of the county, causing flooding at Isabella and in the desert areas. Unusually high flood peaks, some estimated to be in excess of the 100-year flood, were gaged from high-water marks on various streams following the storm (Reference 8).

Between September 29 and October 1, 1976, flash flooding occurred within the South Fork and Kelso Valleys, and in the Pinte Mountains. Flooding was caused by a thunderstorm that moved easterly across the southern area of Lake Isabella. Erskine Creek had a peak discharge of 2,660 cfs causing damage to Uffert Park. This flood has a recurrence interval of approximately 28 years. The KCWA Improvement District No. 3 levees along Kelso Creek were severely damaged by a peak discharge of 11,200 cfs. This flow has a recurrence interval

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of approximately 50 years, and is 1.5 to 2 times the levee design flood (Reference 9).

A large storm in February 1978 produced a peak flow of approximately 8,300 cfs on the Kern River at the First Point gage, near Bakersfield. This flow has a recurrence interval of slightly greater than 70 years. Preliminary data from unpublished records of the USGS and KCWA indicate that the peak flow on Poso Creek near Oildale was 3,570 cfs on February 10, 1978 (Reference 10). This flow has a recurrence interval of slightly less than 11 years.

Major flood problems on the eastern side of the City of McFarland result from the overflow of Poso Creek and runoff from the mountains east of McFarland. Runoff ponds behind the Friant-Kern Canal and flows southerly along the east canal bank. Both the overflow from Poso Creek and runoff from the canal flow north toward McFarland through a siphon beneath State Highway 99. East of State Highway 99, there are overland flows with an average depth of less than 1 foot.

Flooding problems throughout Kern County are aggravated by undersized or insufficient drainage facilities. Even large culverts and bridges may become constricted by debris during flood events.

In addition to flooding from washes, creeks, and rivers, many areas are subject to flooding from flows on alluvial fans. The unpredictability of flow paths on alluvial fans, in addition to typically high sediment loads, compounds the problem.

2.4 Flood Protection Measures

Isabella Dam and Reservoir, completed by the COE in 1954, is the major flood-protection facility for Kern County. The 185-foot-high, 1,695-foot-long earthfill dam holds a maximum of 570,000 acre-feet of water. Isabella Reservoir extends approximately 8 miles upstream on Kern River, and the same distance up South Fork Valley.

Levees exist in the study area that provide the community with some degree of protection from flooding. However, it has been ascertained that small levees, such as those constructed to confine water to irrigation canals (Reference 3), may not protect the community from rare events, such as the 100-year flood. The criteria used to evaluate protection against the 100-year flood are: (1) adequate design, including freeboard, (2) structural stability, and (3) proper operation and maintenance. Levees that do not provide protection from the 100-year flood are not considered in the hydraulic analysis of the 100-year flood plain.

At Bakersfield, flood-control levees have been constructed on both sides of the Kern River to protect the city from flooding. These

flood-control levees contain the 100-year flood and in some places the 500-year flood, and extend for approximately 4 miles along the southern bank and 2.5 miles along the northern bank (Reference 3.)

The Tehachapi-Cummings County Water District operates two flood-control improvement districts that include debris basins, flood channels, and a diversion-detention reservoir, all completed in 1968-69 (Reference 11). These improvements provide some protection for the western half of the city from heavy damage during a 100-year event. The SCS reports that these improvements have been effective during recent storms, although none of the flooding has been of a magnitude equaling or exceeding a 100-year flood (Reference 12). In addition, an unlined trapezoidal channel of small capacity conveys nuisance flows from Blackburn Creek northwesterly around the Tehachapi-Kern County Airport.

The SCS has completed a watershed plan recommending structural measures that include channels and two floodwater-retarding structures, one on Antelope Creek and one on Blackburn Creek. The former will contain the flows of a 1-percent chance (100-year) event; the latter will contain the flows of a 4 percent chance event. The plan has been submitted to Congress for funding.

In 1971, the California Department of Transportation constructed improvements to State Highway 58 from Boron Avenue to the eastern Kern County limit. These improvements included a trapezoidal earth channel running along the northern side of the freeway. The channel maximum design capacity of 600 cfs is not adequate for 100-year floodflows.

Kern County also participates in a comprehensive flood-damage reduction program. For streams having drainage areas larger than 10 square miles, the KCWA has jurisdiction. Streams draining less than 10 square miles are the responsibility of the Kern County Department of Public Works.

In 1970, the KCWA, in cooperation with the COE, completed the Kelso Creek Levee Project. The levee constructed as part of this project does not provide 100-year flood protection. In 1983, the levee experienced more than $200,000 in damage from flooding along Kelso Creek. Other improvements include those along Cuddy Creek, where gabions through several sections have been used to stabilize the channel and prevent excessive erosion.

The KCWA approach to reducing flood damage includes both flood plain management and structural measures. To assess the nature and magnitude of flood hazards, the KCWA prepares hydrology and flood-frequency studies, special storm reports, and flood area delineations. To broaden the streamflow data base, the KCWA also participates in a cooperative stream-gaging program with the USGS. The major result of KCWA activities in flood-damage mitigation was the adoption of a flood plain zoning ordinance in May 1975 (Reference 8).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Region 1. The COE developed discharge-frequency values for the following Ridgecrest flooding sources: North El Paso Wash, Calvert Wash, and North and South Ridgecrest Washes. The COE developed a normalized, regional discharge-frequency curve based on log-Pearson Type III analyses of gaging station data (Reference 9, 13, 14, and 15). The regional curve was transposed to selected concentration points using the standard project flood calculated from a rainfall-runoff simulation. Alluvial-fan widths for Grapevine Canyon, Short Canyon, and Indian Wells Canyon, near Ridgecrest, were computed for each special flood hazard zone using discharge probabilities from log-Pearson Type III analyses in accordance with Water Resources Council Bulletin 17A (Reference 15) and FEMA special flood hazard guidelines for alluvial fans. The regional skew coefficient for alluvial fan sources west of Ridgecrest was determined to be 0.2.

The study contractor developed discharge-frequency values for the remaining flooding sources in Region 1: Claymine Wash, Twentymule Team Creek, Boron Avenue, Little Dixie Wash, and Jawbone Canyon Wash. The same procedure as just described was used to calculate summer peak flows. In addition, the discharge-frequency curves for winter floods were developed using the COE frequency analysis of winter events (Reference 13). The winter and summer discharge-frequency curves were combined on the basis of probability of occurrence.

Region 2. The study contractor developed discharge-frequency values for the following flooding sources: Kelso Creek, Erskine Creek, Breckenridge, Doyle Street, Ward Street, and Hawthorne Avenue. The analyses used SCS Technical Release No. 20 (TR-20) Computer Program for Project Formulation--Hydrology (Reference 16). This is a rainfall-runoff model that considers factors such as precipitation-duration-frequency data, hydrologic soils groups and land use, time of concentration, and storm type. The study contractor compared results from the TR-20 computer model with the results of log-Pearson Type III analyses of nearby gaging station data (Reference 15).

Discharge-frequency values for Cane Canyon, Chollo Canyon, and Short Canyon Creeks were developed by the KCWA. At the confluence of each of these three canyons with Kelso Creek, the discharges presented in this study represent an approximate 80 percent reduction in the estimated total discharge. This was done to account for deposition of sediment along the creeks' flow path (Reference 17).

Discharge-frequency values for the Kern River at Kernville and the South Fork Kern River were developed from gaging station data. The study contractor extended the 24-year record of USGS gage No. 11-187000 to 66 years, using the record of an upstream station. The two-station comparison was made in accordance with the procedure outlined in the U.S. Water Resources Council Bulletin 17A (Reference 15). The study contractor then performed a log-Pearson Type III analysis on the extended data.

Region 3. The study contractor developed discharge-frequency values for the following flooding sources: Upper Sycamore Creek, Cuddy Creek, and Caliente Creek. The SCS conducted the hydrologic analyses for Blackburn and Antelope Creeks. All flooding sources in Region 3 were studied using the TR-20 computer model (Reference 16). The results from the TR-20 model were compared with results of log-Pearson Type III analyses of nearby gaging stations (Reference 15).

A flow split occurs on Caliente Creek downstream of State Highway 58. The distribution of peak flows in each branch was calculated during the hydraulic portion of the study.

Region 4. The COE developed discharge-frequency values for Poso Creek (Reference 18). The COE extended the 20-year stream gage record on Poso Creek to 32 years (Reference 19) by regional correlation analyses using the COE HEC-1 computer program (Reference 20). A log-Pearson Type III analysis was made on the extended data to obtain discharge-frequency values at the gaging station (Reference 15). These values were used to calibrate the COE HEC-1 rainfall-runoff model that generated peak flows for other concentration points on Poso Creek (Reference 21).

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The study contractor developed discharge-frequency values for Blackwells Corner, Sandy Creek, and along State Highway 99 near McFarland and used the TR-20 computer model (Reference 16). The results from the TR-20 model were compared with results of log-Pearson Type III analyses of nearby gaging stations (Reference 15).

The necessary parameters for the shallow floodway near McFarland were obtained from field observations (References 22 and 23). The volume of runoff in this area was compared with available storage east of the Friant-Kern Canal to determine the height of water behind the canal's east bank. This height was found to exceed the bank elevations.

According to FEMA guidelines, when water overtops the canal bank, the canal levees are to be immediately removed. This procedure will result in an analysis similar to a dam-break analysis to determine peak discharge. The SCS Simplified Dam-Breach Routing Score Procedure (Reference 24) gives dependable results for dams greater than 25 feet in height. At lesser heights, the resultant flow estimates tend to be too conservative. For dams of lesser height, the SCS uses a weir equation. Assuming a breach length of 20 feet, the discharge through the opening is 1,000 cfs.

The estimated amount of flow needed to produce a 3-foot-deep, 2,500-foot-wide flood in the City of McFarland was also calculated. Approximately 36,000 cfs would be needed. This value was compared with the maximum value from the dam-breach procedure. Maximum inflow from the drainage areas east of the canal is only 2,550 cfs, and calculations indicate that the discharge through the breach is only 1,000 cfs. Therefore, flooding west of the canal will be shallow.

Peak discharge-drainage area relationships for flooding sources studied by detailed methods are shown in Table 2.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Dimensions of structures affecting the hydraulic computations were field checked by the study contractor to obtain pertinent dimensions.

For most flooding sources, channel and flood plain geometry were obtained using mapping developed by aerial photogrammetry. Digitized cross sections were generated from aerial reconnaissance. For the following flooding sources, the photography was performed by Cooper Aerial Survey on the dates shown: Boron Avenue Creek, Twenty Mule Team Creek, and Claymine Wash (January 18, 1979); Little Dixie Wash, Ridgecrest Wash, North and South El Paso Wash, and Jawbone

Table 2. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Boron Avenue At Confluence With Twenty Mule Team Creek	3.6	580	2,000	3,000	6,700
Calvert Wash At Confluence With North El Paso Wash	12.8	--[1]	--[1]	1,425	--[1]
Claymine Wash At State Highway 58	4.2	--[1]	--[1]	3,200	--[1]
Grapevine Canyon Creek	11.50	3,500	16,000	23,080	38,500
Indian Wells Canyon Creek	18.10	4,000	16,000	24,700	54,000
Jawbone Canyon Wash At Munsey Road	280.4	6,000	25,000	36,000	60,000
Little Dixie Wash At Old Highway 395	215.3	2,400	4,300	4,600	8,000
North El Paso Wash Above Confluence With South El Paso Wash	6.9	--[1]	--[1]	2,000	--[1]
North Ridgecrest Wash At Ridgecrest Corporate Limits	6.9	--[1]	--[1]	1,800	--[1]
Short Canyon Creek	5.49	1,500	6,400	8,620	12,250

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Table 2. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
South El Paso Wash At Ridgecrest Corporate Limits	12.7	--[1]	--[1]	3,000	--[1]
South Ridgecrest Wash At Las Flores Avenue	2.5	--[1]	--[1]	880	--[1]
Twenty Mule Team Creek At AT&SF	44.1	--[1]	--[1]	7,300	--[1]
Breckenridge At Fairfax Road	14.0	520	1,200	1,600	2,900
Cane, Chollo, and Short Canyon Creeks (Combined) At Kelso Creek Flood Plain	21.55	--[1]	--[1]	3,800[2]	--[1]
Doyle Street At Beardsley Canal	2.7	--[1]	--[1]	650	--[1]
Erskine Creek At State Highway 178	37.7	850	2,300	7,700	25,000
Hawthorne Boulevard At Union Avenue	3.0	310	680	1,050	1,950
Kelso Creek At State Highway 178	159.5	2,850	11,000	22,700	68,000
Kern River At Kernville Gaging Stations	1,009.0	13,400	44,000	69,000	186,000
Kern River At Gaging Station 5.8 Miles Northeast of Bakersfield Post Office	2,407.0	2,800	7,000	10,200	28,700

Table 2. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
South Fork Kern River Near Onyx	530.0	3,700	12,000	21,500	76,100
Ward Street At Norris Road	5.9	--[1]	--[1]	1,300	--[1]
Antelope Creek At Tehachapi Western Corporate Limit	25.4	2,730	6,970	9,090	18,000
Blackburn Creek Downstream of Tehachapi Boulevard	28.2	3,310	8,250	12,030	23,000
Blackburn Creek Near Highline Road	4.5	--[1]	--[1]	5,290	--[1]
Caliente Creek At State Highway 58	467.8	--[1]	--[1]	43,000	--[1]
Cuddy Creek At Lebec Road	46.4	850	3,900	7,750	25,000
Upper Caliente Creek Above Bealville Road Bridge	186.1	1,800	7,550	19,800	56,000
Upper Sycamore Creek At Lower End of Valley Road	14.9	260	990	2,900	10,000
Blackwells Corner At State Highway 46	14.3	500	1,460	2,550	6,000

Table 2. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Poso Creek					
At State Highway 58	368	2,900	11,500	19,000	52,000
Sandy Creek					
At East End of Taft Airport	14.0	1,260	1,600	2,100	--[1]
McFarland					
Along State Highway 99	4.2	--[1]	--[1]	2,550	--[1]

[1] Data Not Available
[2] Represents 80 Percent Reduction in Flow

Canyon Wash (May 22, 1979); Kelso Creek (April 4, 1979); Doyle Street (May 22, 1979); Ward Street (April 4, 1979); Upper Sycamore Creek (April 4, 1979); Cuddy Creek (November 16, 1979); Caliente Creek (June 2, 1979); the area of South Bakersfield (November 20, 1978); Sandy Creek (June 2, 1979); Poso Creek and South Branch Poso Creek (February 6, 1979); Blackwells Corner (October 24, 1979); and the area east of State Highway 99 at McFarland (November 1981).

Photographs were taken from 4,800 feet, with a negative scale of 1:9,600. Photogrammetric models were controlled (horizontally and vertically) by the study contractor to third-order accuracy.

Aerial reconnaissance (November 15, 1978) of the Kern River was supplied by the California Department of Water Resources. Photographs were taken from 3,000 feet, with a negative scale of 1:6,000. Photogrammetric models were controlled (horizontally and vertically) by the California Department of Water Resources.

For Blackburn and Antelope Creeks, channel and flood plain geometry was obtained using mapping developed by the SCS. Photogrammetric models were controlled (vertically and horizontally) by field survey to third-order accuracy and field checked. Cross sections for the backwater analyses were obtained from SCS data and supplemented by an existing map (References 25 and 26, respectively).

For Erskine Creek, cross sections for the backwater analysis were developed using a map at a scale of 1:2,400 with a contour interval of 2 feet (Reference 27).

Structural geometry of the Friant-Kern Canal and bridges near McFarland was obtained by the study contractor during field reconnaissance.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For the following streams, water-surface elevations for the selected recurrence intervals were computed using the COE HEC-2 computer program (Reference 28):

Little Dixie Wash
Jawbone Canyon Wash
Boron Avenue
Kern River at Kernville

Kern River at Bakersfield
South Fork Kern River
Kelso Creek
Erskine Creek
Antelope Creek
Upper Sycamore Creek
Cuddy Creek
Caliente Creek
Sandy Creek
Poso Creek
South Branch Poso Creek
Portions of Blackburn Creek

One-hundred year flooding was evaluated for the following shallow flooding sources, using the HEC-2 computer program (Reference 28):

North El Paso Wash
South El Paso Wash
Portions of Twenty Mule Team Creek
Calvert Wash
Claymine Wash
Blackburn Creek
Shallow Flooding Near Bakersfield
Shallow Flooding Near McFarland

The average depths of flow on each of these streams is less than 3 feet; therefore, no profiles have been prepared. Starting water-surface elevations were calculated using the slope-area method.

The following sources of 100-year shallow flooding were analyzed using normal-depth calculations:

Portions of Twenty Mule Team Creek
Breckenridge
Doyle Street
Ward Street
Hawthorne
Portions of Blackburn Creek
Blackwells Corner

Roughness factors (Manning's "n") used in the hydraulic computations were estimated using SCS guidelines (Reference 29). The ranges for all streams studied in detail are shown in Table 3.

Areas subject to alluvial fan flooding include Grapevine Canyon, Short Canyon, and Indian Wells Canyon. Topographic mapping at a scale of 1:1,000, with contour intervals of 5 and 20 feet, were used to determine alluvial fan boundaries.

The KCWA has identified Short, Cane, and Chollo Canyon Creeks, which are tributaries to Kelso Creek, as alluvial fans. The toes

Table 3. Summary of Roughness Coefficients

Flooding Source	Range of "n" Values	
	Channel	Overbank
Region 1		
Little Dixie Wash	0.025-0.035	0.025-0.045
South El Poso Wash	0.030-0.035	0.040-0.045
North El Poso Wash	0.030-0.035	0.040-0.045
South Ridgecrest Wash	0.030	0.040
North Ridgecrest Wash	0.030	0.040
Calvert Wash	0.030	0.040
Boron Avenue	0.025-0.049	0.030-0.085
Twenty Mule Team Creek	0.013-0.075	0.016-0.075
Claymine Road	0.025-0.070	0.025-0.070
Jawbone Canyon Wash	0.030-0.045	0.045
Region 2		
Kern River at Kernville	0.036-0.041	0.040-0.065
Kern River at Bakersfield	0.030-0.065	0.035-0.065
South Fork Kern River	0.032-0.055	0.042-0.062
Erskine Creek	0.035-0.070	0.035-0.070
Breckenridge	0.040-0.050	0.040-0.050
Doyle Street	0.010-0.060	0.010-0.060
Ward Street	0.025-0.030	0.025-0.045
Kelso Creek	0.035-0.050	0.035-0.050
Hawthorne	0.012-0.046	0.012-0.046
McFarland, East of State Highway 99	0.025-0.030	0.025-0.045

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Table 3. Summary of Roughness Coefficients (Cont'd)

Flooding Source	Range of "n" Values	
	Channel	Overbank
Region 3		
Blackburn Creek	0.030-0.050	0.030-0.050
Antelope Creek	0.050	0.050
Cuddy Creek	0.030-0.045	0.035-0.050
Ranger Station Creek	0.030-0.033	0.055-0.059
Upper Sycamore Creek	0.020-0.042	0.024-0.042
Caliente Creek	0.024-0.060	0.025-0.059
Region 4		
Sandy Creek	0.024-0.040	0.024-0.045
Poso Creek	0.025	0.030-0.035
Blackwells Corner	0.040	0.040-0.045

of these tributary fans are included in the analysis of the Kelso Creek flood plain.

Alluvial fan depth, width, and velocity were computed using discharge probabilities from log-Pearson Type III analyses in accordance with U.S. Water Resources Council Bulletin 17A (Reference 15) and FEMA special flood hazard guidelines for alluvial fans (Reference 30).

Because the area east of China Lake Naval Weapons Center is undeveloped, the hydraulic analyses of the fans assumed unobstructed flow. Interstate Highway 395 and State Highway 14, although crossing the base of the fans perpendicularly, would not obstruct natural flows, because they are not elevated.

There are several small culverts under Interstate Highway 395 that would convey nuisance water from the more frequent storms. During 100-year peak flows, these would become silted and be considered ineffective.

Flows from Indian Wells Canyon are contained in a well-defined channel above State Highway 14. During the storm of 1945, flow broke through a dirt bank just upstream of State Highway 14 and flowed north. This bank has since been reinforced with large boulders and dirt.

In accordance with FEMA guidelines, the alluvial fan is characterized by unstable channel systems due to slope and soil conditions. Consequently, flows rarely spread evenly over the surface of an alluvial fan and can be concentrated in an identifiable temporary channel, or confined to only portions of the fan surface. The ability to scour and deposit sediment makes flow paths prone to lateral migration and relocation to any portion of the fan during a single runoff event and subsequent events. This erratic, unpredictable behavior subjects all portions of the fan to potential flood hazard, regardless of location. As the fan widens, the probability of flooding at a given depth and velocity at a specific point generally decreases.

The 100-year flooding for the approximate-study reach of the Poso Creek split flow was estimated using normal-depth calculations. The flooding for the Kern River Flood Canal approximate study was based on a HEC-2 analysis prepared by the California Department of Water Resources. The 100-year flooding for other approximate studies was estimated using normal-depth calculations.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:2,400, 1:4,800, and 1:6,000, with contour intervals of 2, 4, 5, and 20 feet (References 26, 27, and 31).

The flood plain boundaries for Caliente Creek were determined by the KCWA (Reference 32). The 500-year flood plain boundaries for the City of Ridgecrest were delineated from COE Flood Plain Information maps (Reference 7).

The alluvial fan boundaries for Grapevine, Short, and Indian Well Canyon Creeks were delineated using topographic maps enlarged to a scale of 1:12,000, with a contour interval of 20 feet (Reference 33).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown. The boundaries were delineated using topographic maps at a scale of 1:24,000, with contour intervals of 5, 10, 20, 40, and 50 feet (Reference 34).

Approximate 100-year flood plain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map for Kern County (Reference 35).

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 4).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Antelope Creek								
A	0	76	724	16.6	3,794.9	3,794.9	3,794.9	0.0
B	350	93	786	15.3	3,810.2	3,810.2	3,810.2	0.0
C	1,250	141	941	12.8	3,834.8	3,834.8	3,834.8	0.0
D	1,870	126	812	14.8	3,850.8	3,850.8	3,850.8	0.0
E	2,380	153	910	13.2	3,861.4	3,861.4	3,861.4	0.0
F	2,680	375	1,240	9.7	3,871.0	3,871.0	3,871.0	0.0
G	2,841	376	3,661	3.3	3,886.1	3,886.1	3,886.1	0.0
H	3,116	362	2,632	4.6	3,886.2	3,886.2	3,886.2	0.0
I	3,336	276	1,012	11.9	3,886.5	3,886.5	3,886.5	0.0
J	3,566	388	1,251	9.6	3,893.3	3,893.3	3,893.3	0.0
K	3,774	368	2,343	3.9	3,899.4	3,899.4	3,899.4	0.0
L	4,224	244	857	10.6	3,901.2	3,901.2	3,901.9	0.7
M	4,664	504/289[2]	2,281	4.0	3,905.0	3,905.0	3,905.9	0.9

[1]Feet Above Limit of Detailed Study [2]Width/Width Within County

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

ANTELOPE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Blackburn Creek								
A	2,510	275/45[2]	1,380	6.6	3,925.4	3,925.4	3,926.4	1.0
B	2,870	443/208[2]	1,534	5.9	3,928.6	3,928.6	3,928.6	0.0
C	3,210	139	638	12.3	3,931.2	3,931.2	3,931.2	0.0

[1]Feet Above Antelope Creek [2]Width/Width Within County

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

BLACKBURN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Boron Avenue Creek								
A	0	1,365	1,405	2.8	2,443.1	2,443.1	2,443.1	0.0
B	360	1,785	1,877	2.1	2,446.0	2,446.0	2,446.0	0.0
C	2,010	1,020	1,474	2.6	2,447.6	2,447.6	2,447.6	0.0
D	2,100	980	4,823	0.6	2,452.0	2,452.0	2,452.0	0.0
E	2,600	862	1,213	2.5	2,452.1	2,452.1	2,452.1	0.0
F	3,500	1,000	986	3.0	2,457.6	2,457.6	2,458.0	0.4
G	4,645	200	539	5.6	2,466.2	2,466.2	2,466.6	0.4
H	5,475	373	699	4.3	2,469.0	2,469.0	2,469.8	0.8
I	6,125	430	522	5.7	2,474.0	2,474.0	2,474.8	0.8
J	6,625	416	644	4.7	2,480.7	2,480.7	2,481.3	0.6

[1]Feet Above Limit of Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

BORON AVENUE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Caliente Creek								
A	0	282	6,477	5.1	1,230.4	1,230.4	1,231.4	1.0
B	630	244	4,274	7.7	1,230.6	1,230.6	1,231.6	1.0
C	1,240	242	2,257	14.5	1,230.9	1,230.9	1,231.7	0.8
D	1,980	249	2,115	15.5	1,242.2	1,242.2	1,242.3	0.1
E	2,390	238	2,348	14.0	1,247.9	1,247.9	1,248.7	0.8
F	2,940	297	2,519	13.0	1,254.6	1,254.6	1,255.3	0.7
G	3,660	340	2,366	13.8	1,262.7	1,262.7	1,263.5	0.8
H	4,600	715	3,631	9.0	1,273.7	1,273.7	1,274.7	1.0
I	5,760	620	2,775	11.8	1,287.3	1,287.3	1,287.3	0.0
J	6,810	433	3,030	10.8	1,298.0	1,298.0	1,298.1	0.1
K	7,070	633	9,687	3.4	1,304.7	1,304.7	1,305.7	1.0
L	7,610	400	1,731	11.4	1,304.7	1,304.7	1,305.7	1.0
M	8,460	788	2,647	7.5	1,313.7	1,313.7	1,314.5	0.8
N	8,560	781	2,079	9.5	1,315.7	1,315.7	1,315.8	0.1
O	8,945	450	2,359	8.4	1,321.7	1,321.7	1,322.6	0.9
P	9,775	500	1,801	11.0	1,328.1	1,328.1	1,328.8	0.7
Q	10,755	385	1,764	11.2	1,341.6	1,341.6	1,342.5	0.9
R	11,775	253	1,493	13.3	1,353.4	1,353.4	1,353.7	0.3
S	12,785	300	1,623	12.2	1,366.0	1,366.0	1,366.9	0.9
T	13,585	205	1,348	14.7	1,376.8	1,376.8	1,377.5	0.7
U	14,185	211	1,400	14.1	1,387.0	1,387.0	1,387.9	0.9
V	14,925	211	1,399	14.2	1,397.1	1,397.1	1,397.8	0.7

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CALIENTE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Cuddy Creek								
A	2,620	2,750	--[2]	--[2]	3,551.3	--[2]	--[2]	--[2]
B	3,650	160	--[2]	--[2]	3,574.8	--[2]	--[2]	--[2]
C	4,470	130	--[2]	--[2]	3,593.3	--[2]	--[2]	--[2]
D	4,880	190	--[2]	--[2]	3,605.1	--[2]	--[2]	--[2]
E	5,730	160	--[2]	--[2]	3,625.7	--[2]	--[2]	--[2]
F	6,470	160	--[2]	--[2]	3,643.2	--[2]	--[2]	--[2]
G	6,820	180	--[2]	--[2]	3,653.2	--[2]	--[2]	--[2]
H	7,420	180	--[2]	--[2]	3,669.6	--[2]	--[2]	--[2]
I	7,890	170	--[2]	--[2]	3,685.2	--[2]	--[2]	--[2]
J	8,280	190	--[2]	--[2]	3,697.4	--[2]	--[2]	--[2]
K	8,680	140	--[2]	--[2]	3,707.9	--[2]	--[2]	--[2]
L	8,910	180	--[2]	--[2]	3,713.4	--[2]	--[2]	--[2]
M	9,240	170	--[2]	--[2]	3,721.3	--[2]	--[2]	--[2]
N	9,730	210	--[2]	--[2]	3,739.0	--[2]	--[2]	--[2]
O	10,270	200	--[2]	--[2]	3,754.7	--[2]	--[2]	--[2]
P	10,780	180	--[2]	--[2]	3,764.9	--[2]	--[2]	--[2]
Q	11,360	170	--[2]	--[2]	3,784.3	--[2]	--[2]	--[2]
R	11,930	170	--[2]	--[2]	3,805.1	--[2]	--[2]	--[2]
S	11,950	170	--[2]	--[2]	3,805.4	--[2]	--[2]	--[2]
T	12,943	150	--[2]	--[2]	3,836.5	--[2]	--[2]	--[2]
U	13,943	120	--[2]	--[2]	3,865.3	--[2]	--[2]	--[2]
V	14,593	135	614	12.6	3,884.1	3,884.1	3,884.1	0.0
W	15,413	108	586	13.2	3,912.2	3,912.2	3,912.2	0.0
X	16,013	554	999	7.8	3,930.9	3,930.9	3,930.9	0.0
Y	16,553	320	946	8.2	3,950.6	3,950.6	3,950.6	0.0
Z	17,333	258	627	12.4	3,983.8	3,983.8	3,983.8	0.0

[1]Feet Above Limit of Detailed Study [2]Data Not Available

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CUDDY CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Cuddy Creek (Cont'd)								
AA	17,773	96	561	13.8	4,000.7	4,000.7	4,000.7	0.0
AB	18,423	190	708	11.0	4,020.1	4,020.1	4,020.1	0.0
AC	19,113	338	980	7.4	4,043.1	4,043.1	4,043.1	0.0
AD	19,813	151	625	11.6	4,046.8	4,046.8	4,046.8	0.0
AE	20,853	144	615	11.8	4,113.7	4,113.7	4,113.7	0.0
AF	21,583	189	675	10.7	4,155.8	4,155.8	4,156.8	1.0
AG	22,213	322	767	9.4	4,183.6	4,183.6	4,183.6	0.0
AH	22,983	165	643	11.3	4,223.1	4,223.1	4,223.1	0.0
AI	23,673	305	789	9.2	4,254.3	4,254.3	4,254.4	0.1
AJ	24,529	395	797	9.1	4,293.9	4,293.9	4,293.9	0.0
AK	25,069	504	960	7.6	4,316.9	4,316.9	4,316.9	0.0
AL	25,619	155	629	11.5	4,343.7	4,343.7	4,344.5	0.8
AM	26,569	200	703	10.3	4,390.5	4,390.5	4,390.8	0.3
AN	27,219	127	654	11.1	4,422.8	4,422.8	4,423.6	0.8
AO	28,049	80	503	14.4	4,465.2	4,465.2	4,465.9	0.7
AP	28,629	94	507	13.3	4,497.3	4,497.3	4,497.3	0.0
AQ	29,669	370	--[2]	--[2]	4,543.3	--[2]	--[2]	--[2]
AR	30,379	330	--[2]	--[2]	4,571.3	--[2]	--[2]	--[2]
AS	30,979	360	--[2]	--[2]	4,599.3	--[2]	--[2]	--[2]
AT	31,579	170	--[2]	--[2]	4,627.2	--[2]	--[2]	--[2]
AU	32,407	260	--[2]	--[2]	4,652.6	--[2]	--[2]	--[2]
AV	33,157	220	--[2]	--[2]	4,683.7	--[2]	--[2]	--[2]
AW	33,737	250	--[2]	--[2]	4,710.5	--[2]	--[2]	--[2]
AX	34,287	130	--[2]	--[2]	4,735.5	--[2]	2	--[2]
AY	34,952	160	--[2]	--[2]	4,763.0	--[2]	--[2]	--[2]
AZ	35,122	131	569	11.9	4,776.2	4,776.2	4,776.2	0.0

[1]Feet Above Limit of Detailed Study [2]Data Not Available (See Section 4.2)

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CUDDY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Cuddy Creek (Cont'd)								
BA	35,832	95	524	11.4	4,794.5	4,794.5	4,794.5	0.0
BB	36,412	160	621	9.7	4,819.5	4,819.5	4,819.5	0.0
BC	37,022	117	527	11.4	4,842.6	4,842.6	4,842.6	0.0
BD	37,852	127	589	10.2	4,875.9	4,875.9	4,875.9	0.0
BE	38,392	116	522	11.5	4,898.4	4,898.4	4,898.4	0.0
BF	39,022	238	733	8.2	4,919.3	4,919.3	4,919.3	0.0
BG	39,712	152	567	10.6	4,939.3	4,939.3	4,939.3	0.0
BH	40,442	62	426	14.1	4,962.9	4,962.9	4,962.9	0.0
BI	40,977	103	499	12.0	4,979.5	4,979.5	4,979.5	0.0
BJ	41,992	209	677	8.9	5,003.7	5,003.7	5,003.7	0.0
BK	42,792	185	641	9.4	5,025.6	5,025.6	5,025.6	0.0
BL	43,427	107	525	11.4	5,042.2	5,042.2	5,042.2	0.0
BM	43,987	141	537	11.7	5,054.5	5,054.5	5,054.5	0.0
BN	44,617	191	616	9.7	5,065.8	5,065.8	5,065.8	0.0
BO	45,207	135	589	10.2	5,078.8	5,078.8	5,078.8	0.0
BP	45,652	123	509	11.8	5,090.4	5,090.4	5,090.4	0.0
BQ	46,077	142	576	10.4	5,097.4	5,097.4	5,097.4	0.0
BR	46,477	222	664	7.9	5,101.3	5,101.3	5,101.3	0.0
BS	46,837	56	363	14.5	5,102.2	5,102.2	5,102.4	0.2
BT	47,267	263	743	7.1	5,111.3	5,111.3	5,111.5	0.2
BU	47,627	209	699	7.5	5,116.8	5,116.8	5,117.7	0.9
BV	48,092	47	420	12.5	5,123.9	5,123.9	5,123.9	0.0
BW	48,482	110	512	10.3	5,131.3	5,131.3	5,131.8	0.5
BX	48,962	279	783	6.7	5,139.6	5,139.6	5,139.9	0.3
BY	49,412	411	1,085	4.8	5,141.4	5,141.4	5,142.0	0.6
BZ	50,272	97	260	7.7	5,154.6	5,154.6	5,155.6	1.0

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CUDDY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Cuddy Creek (Cont'd)								
CA	51,007	67	202	9.9	5,174.6	5,174.6	5,175.1	0.5
CB	51,562	57	196	10.2	5,191.6	5,191.6	5,192.4	0.8
CC	51,992	30	154	13.0	5,204.3	5,204.3	5,204.3	0.0
CD	52,442	33	158	12.7	5,216.4	5,216.4	5,216.4	0.0
CE	52,892	42	178	11.3	5,223.1	5,223.1	5,224.1	1.0
CF	53,287	62	192	10.4	5,236.2	5,236.2	5,236.2	0.0

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CUDDY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Erskine Creek								
A	270	330	1,795	4.3	2,430.5	2,430.5	2,430.5	0.0
B	670	427	675	11.4	2,434.0	2,434.0	2,434.0	0.0
C	970	530	1,000	7.7	2,445.7	2,445.7	2,445.7	0.0
D	1,470	600	1,122	6.9	2,454.0	2,454.0	2,454.5	0.5
E	1,890	670	1,073	7.2	2,462.1	2,462.1	2,462.7	0.6
F	2,150	560	1,463	5.3	2,464.9	2,464.9	2,465.8	0.9
G	2,800	531	964	8.0	2,476.0	2,476.0	2,476.0	0.0
H	3,520	505	1,026	7.5	2,493.0	2,493.0	2,493.7	0.7
I	3,970	691	1,230	6.3	2,503.1	2,503.1	2,503.5	0.4
J	4,510	575	928	8.3	2,514.8	2,514.8	2,514.8	0.0
K	5,160	638	4,973	1.5	2,533.1	2,533.1	2,533.1	0.0
L	5,760	450	913	8.4	2,553.0	2,553.0	2,553.0	0.0
M	7,060	340	948	8.1	2,591.5	2,591.5	2,591.6	0.1
N	8,120	198	740	10.4	2,628.9	2,628.9	2,628.9	0.0
O	8,970	189	722	10.7	2,659.3	2,659.3	2,659.3	0.0
P	9,770	165	667	11.5	2,692.3	2,692.3	2,692.3	0.0
Q	10,490	138	670	11.5	2,719.7	2,719.7	2,719.7	0.0
R	11,370	98	560	13.7	2,763.4	2,763.4	2,763.4	0.0
S	12,120	112	646	11.9	2,791.6	2,791.6	2,791.6	0.0
T	12,770	149	682	11.3	2,814.2	2,814.2	2,814.2	0.0

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

ERSKINE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Jawbone Canyon Wash								
A	3,290	1,323	5,163	7.0	1,993.4	1,993.4	1,993.4	0.0
B	3,560	1,361	6,526	5.5	1,994.7	1,994.7	1,995.1	0.4
C	3,770	1,435	6,757	5.3	1,995.2	1,995.2	1,995.7	0.5
D	5,650	1,846	4,974	7.2	2,003.7	2,003.7	2,004.5	0.8
E	7,050	1,838	8,802	4.1	2,008.7	2,008.7	2,009.4	0.7
F	8,110	1,401	3,883	9.3	2,013.2	2,013.2	2,013.2	0.0
G	8,610	1,241	6,180	5.8	2,017.2	2,017.2	2,017.6	0.4
H	9,020	1,303	7,789	4.6	2,018.2	2,018.2	2,018.8	0.6
I	10,220	926	5,579	6.5	2,020.5	2,020.5	2,021.3	0.8
J	11,480	1,189	6,722	5.4	2,024.3	2,024.3	2,025.1	0.8
K	13,530	1,641	6,578	5.5	2,029.7	2,029.7	2,030.2	0.5

[1] Feet Above Munsey Road

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS

FLOODWAY DATA

JAWBONE CANYON WASH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Kelso Creek								
A	0	881	3,003	7.6	2,737.2	2,737.2	2,737.9	0.7
B	1,120	1,328[2]	3,434	6.6	2,746.6	2,746.6	2,747.3	0.7
C	2,220	1,527[2]	3,619	6.3	2,756.5	2,756.5	2,757.5	1.0
D	3,170	1,230[2]	2,590	8.8	2,766.8	2,766.8	2,767.5	0.7
E	4,145	1,580[2]	3,992	5.7	2,776.7	2,776.7	2,777.7	1.0
F	6,565	1,750[2]	3,631	6.3	2,804.6	2,804.6	2,805.2	0.6
G	10,795	1,834[2]	3,262	7.0	2,868.8	2,868.8	2,869.7	0.9
H	13,665	1,440[2]	2,364	9.6	2,917.0	2,917.0	2,917.3	0.3

[1] Feet Above Cross Section A

[2] Includes Width of Tributaries (Short Canyon Creek, Cane Canyon Creek, Chollo Canyon North and Chollo Canyon South)

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

KELSO CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Kern River At Kernville								
A	0	1,502	8,440	8.2	2,601.6	2,601.6	2,602.6	1.0
B	720	1,728	8,679	8.0	2,604.9	2,604.9	2,605.4	0.5
C	1,990	1,865	7,920	8.7	2,611.8	2,611.8	2,611.8	0.0
D	3,010	2,070	8,301	8.3	2,616.9	2,616.9	2,617.1	0.2
E	4,140	2,597	9,894	7.0	2,622.1	2,622.1	2,622.1	0.0
F	5,330	1,243	6,304	10.9	2,626.7	2,626.7	2,626.7	0.0
G	6,730	562	5,361	12.9	2,633.9	2,633.9	2,633.9	0.0
H	7,770	990	6,501	10.6	2,638.5	2,638.5	2,638.8	0.3
I	8,510	1,175	9,880	7.0	2,641.8	2,641.8	2,641.9	0.1
J	8,835	900	7,170	9.6	2,641.9	2,641.9	2,642.0	0.1
K	9,391	368	5,071	13.6	2,644.1	2,644.1	2,644.2	0.1
L	10,901	815	5,051	13.7	2,652.7	2,652.7	2,652.7	0.0
M	12,151	843	7,119	9.7	2,660.5	2,660.5	2,660.6	0.1
N	12,431	572	5,390	12.8	2,661.5	2,661.5	2,661.5	0.0
O	13,091	840	7,929	8.7	2,664.6	2,664.6	2,665.5	0.9
P	14,021	1,390[2]	5,520	12.5	2,671.1	2,671.1	2,671.1	0.0
Q	15,261	922	6,403	10.8	2,680.9	2,680.9	2,680.9	0.0
R	16,461	920	6,061	11.4	2,687.1	2,687.1	2,687.1	0.0
S	17,421	1,280	6,797	10.2	2,692.8	2,692.8	2,692.8	0.0
T	18,431	1,760	6,938	9.9	2,699.9	2,699.9	2,700.0	0.1
U	19,351	1,040	5,088	13.6	2,704.6	2,704.6	2,704.6	0.0
V	20,451	953[2]	4,778	14.4	2,712.8	2,712.8	2,712.8	0.0
W	20,981	1,110[2]	5,025	13.7	2,718.1	2,718.1	2,718.1	0.0
X	21,501	1,045[2]	4,456	15.5	2,723.8	2,723.8	2,723.8	0.0
Y	22,411	927	7,354	9.4	2,730.8	2,730.8	2,731.0	0.2
Z	23,011	600	4,874	14.2	2,734.9	2,734.9	2,735.2	0.3

[1]Feet Above Limit of Detailed Study [2]Width Includes High Ground

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

KERN RIVER AT KERNVILLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Kern River At Kernville (Cont'd)								
AA	23,521	295	3,687	18.7	2,740.4	2,740.4	2,740.4	0.0
AB	24,291	470	5,543	12.4	2,748.5	2,748.5	2,748.9	0.4
AC	24,771	495	5,560	12.4	2,751.6	2,751.6	2,751.6	0.0
AD	25,771	581	4,804	14.4	2,756.8	2,756.8	2,756.8	0.0
AE	26,521	874/323[2]	5,612	12.3	2,769.0	2,769.0	2,769.0	0.0

[1]Feet Above Limit of Detailed Study [2]Width/Width Within Kern County

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

KERN RIVER AT KERNVILLE

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Little Dixie Wash								
A	0	379	2,151	2.1	2,411.3	2,411.3	2,412.2	0.9
B	170	439	1,639	2.8	2,411.6	2,411.6	2,412.3	0.7
C	1,550	115	432	10.7	2,419.0	2,419.0	2,419.1	0.1
D	2,925	200	852	5.4	2,427.4	2,427.4	2,428.2	0.8
E	4,655	90	396	11.6	2,438.2	2,438.2	2,439.2	1.0
F	5,735	150	773	5.9	2,446.6	2,446.6	2,447.1	0.5
G	7,135	325	709	6.5	2,453.1	2,453.1	2,453.9	0.8
H	7,835	113	468	9.8	2,458.9	2,458.9	2,459.8	0.9

[1]Feet Above Invokern Road

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

LITTLE DIXIE WASH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Poso Creek								
A	0	156	507	9.9	415.0	415.0	415.0	0.0
B	3,470	2,000	3,057	2.8	422.7	422.7	423.7	1.0
C	4,870	2,049	1,738	4.9	425.4	425.4	426.4	1.0
D	6,870	3,150	2,444	3.5	430.6	430.6	431.6	1.0
E	7,470	2,900	2,566	3.3	432.5	432.5	433.2	0.7
F	8,570	3,000	1,395	6.1	434.8	434.8	435.7	0.9
G	10,920	1,573	1,683	5.1	441.6	441.6	441.6	0.0
H	12,580	1,300	2,250	3.8	445.2	445.2	445.3	0.1
I	13,680	1,650	1,659	5.1	446.7	446.7	447.5	0.8
J	14,830	1,660	2,581	3.3	450.7	450.7	450.8	0.1
K	18,750	1,767	1,555	5.5	458.7	458.7	458.7	0.0
L	26,860	1,860	3,172	6.0	480.4	480.4	480.5	0.1
M	29,160	1,646	4,016	4.7	485.9	485.9	486.2	0.3
N	30,510	1,715	3,199	5.9	488.9	488.9	489.3	0.4
O	31,610	1,627	3,450	5.5	492.9	492.9	492.9	0.0
P	34,060	1,750	4,761	4.0	497.1	497.1	498.0	0.9
Q	35,410	948	2,866	6.6	500.2	500.2	500.2	0.0
R	36,660	1,189	6,700	2.8	501.5	501.5	501.8	0.3
S	38,000	324	1,526	12.4	502.2	502.2	502.2	0.0
T	39,450	519	2,126	8.9	509.7	509.7	509.8	0.1
U	40,900	473	2,319	8.2	514.1	514.1	514.2	0.1
V	41,980	573	3,944	4.8	515.5	515.5	516.0	0.5
W	43,360	241	1,383	13.7	516.5	516.5	516.7	0.2
X	44,810	236	1,587	12.0	522.6	522.6	523.5	0.9
Y	45,380	213	1,423	13.3	526.0	526.0	526.1	0.1

[1]Feet Above State Highway 99

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

POSO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Ranger Station Creek								
A	810	217	519	6.5	5,152.7	5,152.7	5,152.9	0.2
B	1,140	73	296	11.5	5,157.9	5,157.9	5,158.0	0.1
C	1,965	103	351	9.7	5,173.4	5,173.4	5,173.6	0.2
D	2,600	73	306	11.1	5,182.8	5,182.8	5,182.9	0.1
E	3,050	115	453	7.5	5,186.4	5,186.4	5,187.3	0.9
F	3,470	69[2]	299	11.4	5,192.0	5,192.0	5,192.3	0.3

[1]Feet Above Cuddy Creek [2]Floodway Outside Corporate Limits

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

RANGER STATION CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA[2] (SQUARE FEET)	MEAN VELOCITY[2] (FEET PER SECOND)	REGULATORY	WITHOUT[2] FLOODWAY	WITH[2] FLOODWAY	INCREASE[2]
					(FEET NGVD)			
Sandy Creek								
A	15,352	475/200[3]			998.3			
B	17,692	167			1,056.6			
C	19,092	94			1,093.0			
D	20,752	98			1,137.5			
E	21,652	282			1,169.3			
F	21,838	286			1,170.9			
G	22,768	119			1,189.3			

[1]Feet Above Confluence with North Sandy Creek [2]Data Not Available
[3]Width/Width Within Kern County

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SANDY CREEK

2/4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Branch Poso Creek								
A	0	4,442	10,811	1.0	443.0	443.0	444.0	1.0
B	1,000	1,720	5,579	1.9	443.5	443.5	444.2	0.7
C	2,650	1,485	3,109	3.4	444.6	444.6	445.3	0.7
D	4,800	1,073	2,146	4.9	450.4	450.4	451.1	0.7
E	7,150	1,713	3,432	3.1	455.5	455.5	456.1	0.6

[1]Feet Above State Highway 99

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH BRANCH POSO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Fork Kern River								
A	0	2,350	8,284	3.9	2,597.3	2,597.3	2,598.3	1.0
B	2,240	2,970	5,977	5.4	2,605.8	2,605.8	2,605.8	0.0
C	4,470	2,280	9,854	3.2	2,614.4	2,614.4	2,615.0	0.6
D	6,170	2,107	8,820	3.5	2,618.6	2,618.6	2,618.9	0.3
E	6,270	2,000	6,524	4.7	2,618.7	2,618.7	2,619.0	0.3
F	6,303	2,000	13,427	2.3	2,622.6	2,622.6	2,622.6	0.0
G	6,403	2,120	12,591	2.4	2,622.6	2,622.6	2,622.6	0.0
H	9,103	2,110	3,420	8.9	2,625.2	2,625.2	2,625.5	0.3
I	11,953	2,340	9,600	3.0	2,634.3	2,634.3	2,634.7	0.4
J	13,733	1,350	4,226	6.5	2,637.4	2,637.4	2,637.7	0.3
K	15,373	980	5,622	4.9	2,642.5	2,642.5	2,642.8	0.3
L	18,013	2,446	3,447	7.6	2,651.8	2,651.8	2,651.8	0.0
M	18,114	2,450	4,010	6.5	2,654.9	2,654.9	2,655.2	0.3
N	18,155	2,450	6,712	3.9	2,655.9	2,655.9	2,656.4	0.5
O	18,256	2,500	10,747	2.2	2,656.1	2,656.1	2,656.7	0.6
P	19,896	1,600	5,771	3.8	2,657.5	2,657.5	2,657.8	0.3
Q	21,971	1,270	3,712	6.0	2,664.7	2,664.7	2,664.8	0.1
R	24,146	1,470	6,195	3.6	2,671.4	2,671.4	2,672.1	0.7
S	26,146	1,000	3,447	6.4	2,677.5	2,677.5	2,677.9	0.4
T	27,946	1,450	6,224	3.6	2,683.5	2,683.5	2,684.1	0.6
U	29,871	2,050	6,144	3.6	2,687.9	2,687.9	2,688.2	0.3
V	31,941	1,250	4,446	5.0	2,694.1	2,694.1	2,694.7	0.6
W	33,966	1,190	5,170	4.3	2,699.2	2,699.2	2,699.9	0.7
X	35,726	1,240	5,485	4.0	2,702.4	2,702.4	2,703.1	0.7
Y	37,386	1,000	5,435	4.1	2,704.8	2,704.8	2,705.4	0.6
Z	37,616	1,320	10,461	2.1	2,709.7	2,709.7	2,709.8	0.1

[1] Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH FORK KERN RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Fork Kern River (Cont'd)								
AA	38,516	580	2,045	10.8	2,709.7	2,709.7	2,710.1	0.4
AB	40,216	450	4,292	5.0	2,717.9	2,717.9	2,718.8	0.9
AC	42,246	380	2,674	8.0	2,722.3	2,722.3	2,723.3	1.0
AD	43,646	310	3,076	7.0	2,729.3	2,729.3	2,730.1	0.8
AE	45,396	480	3,519	6.1	2,735.0	2,735.0	2,735.7	0.7
AF	47,196	420	3,777	5.7	2,740.6	2,740.6	2,741.0	0.4
AG	48,971	236	2,386	9.0	2,746.5	2,746.5	2,746.8	0.3
AH	51,471	950	4,261	5.0	2,758.6	2,758.6	2,759.2	0.6

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH FORK KERN RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Upper Sycamore Creek								
A	0	71	308	9.4	4,027.6	4,027.6	4,027.6	0.0
B	740	83	372	7.8	4,032.4	4,032.4	4,032.4	0.0
C	1,505	69	379	6.1	4,034.9	4,034.9	4,034.9	0.0
D	2,255	319	583	5.0	4,040.1	4,040.1	4,040.1	0.0
E	2,305	299	1,038	2.8	4,040.5	4,040.5	4,040.5	0.0
F	2,665	320	934	3.1	4,040.8	4,040.8	4,040.8	0.0
G	2,706	346	947	3.1	4,040.8	4,040.8	4,040.8	0.0
H	2,966	751	2,614	1.1	4,041.0	4,041.0	4,041.0	0.0
I	3,781	1,023	3,339	0.9	4,041.1	4,041.1	4,041.1	0.0
J	4,381	261	828	3.5	4,041.1	4,041.1	4,041.1	0.0
K	4,901	176	287	7.3	4,043.3	4,043.3	4,044.3	1.0
L	5,651	415	854	2.4	4,046.3	4,046.3	4,047.3	1.0
M	6,751	266	346	6.0	4,049.9	4,049.9	4,050.3	0.4
N	7,491	512	900	2.3	4,052.5	4,052.5	4,052.8	0.3
O	7,566	501	907	2.3	4,059.5	4,059.5	4,060.5	1.0
P	7,766	1,206	5,959	0.3	4,059.9	4,059.9	4,060.5	0.6
Q	8,466	365	814	2.6	4,060.1	4,060.1	4,060.9	0.8
R	9,116	304	437	4.8	4,063.7	4,063.7	4,064.4	0.7
S	9,616	153	290	7.2	4,070.9	4,070.9	4,071.2	0.3
T	9,936	99	232	9.0	4,077.5	4,077.5	4,078.4	0.9
U	10,346	199	350	6.0	4,085.2	4,085.2	4,085.8	0.6
V	10,836	61	200	10.4	4,093.5	4,093.5	4,093.5	0.0
W	11,481	137	317	6.6	4,102.6	4,102.6	4,103.1	0.5
X	12,011	114	286	2.2	4,103.9	4,103.9	4,104.6	0.7
Y	13,251	471	1,613	0.4	4,104.0	4,104.0	4,104.7	0.7
Z	14,191	708	2,182	0.3	4,104.1	4,104.1	4,104.8	0.7

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

UPPER SYCAMORE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Upper Sycamore Creek (Cont'd)								
AA	15,101	985	3,808	0.2	4,104.1	4,104.1	4,104.8	0.7
AB	15,801	838	2,873	0.2	4,104.1	4,104.1	4,104.8	0.7
AC	16,576	428	617	1.0	4,104.4	4,104.4	4,104.9	0.5
AD	17,351	246	279	2.3	4,105.9	4,105.9	4,106.0	0.1
AE	18,791	176	149	3.2	4,113.3	4,113.3	4,113.4	0.1
AF	20,191	98	88	5.5	4,143.7	4,143.7	4,143.7	0.0
AG	21,151	421	322	1.0	4,169.8	4,169.8	4,169.8	0.0

[1]Feet Above Limit of Detailed Study

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOODWAY DATA

UPPER SYCAMORE CREEK

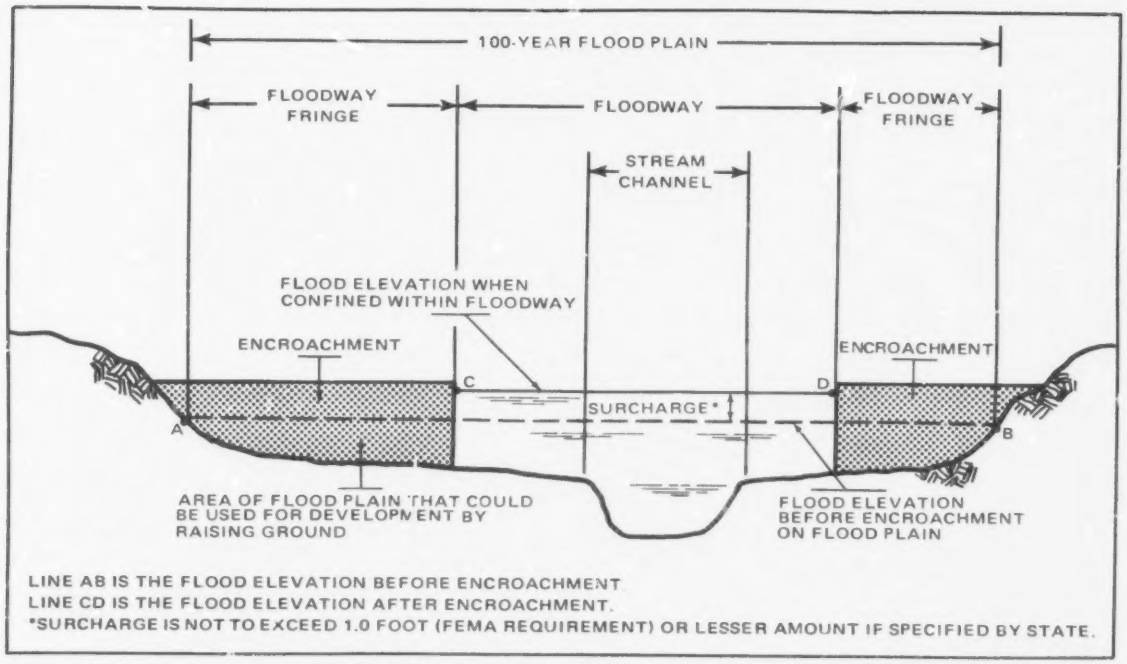
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

In areas of shallow and alluvial fan flooding, the unpredictable flow paths make delineation of a floodway that would meet FEMA criteria impossible. However, the community should regulate development in swales and identifiable stream channels because of historical evidence of flow in such areas.

Because of high velocities on portions of Cuddy Creek, and through extensive coordination with the KCWA and FEMA, the floodway boundary was agreed to be approximately 50 feet back from the bank when flow was supercritical. Data for these areas were not included in Table 4. In other areas, where overbank velocities exceeded 7 feet per second, floodway boundaries were made coincident with the 100-year flood plain boundaries.

Because the Kelso Creek levee does not meet FEMA standards for freeboard, a floodway was computed for the reach of Kelso Creek along the levee. Below the levee, the flow is not channelized, and a floodway would not be appropriate.

For portions of Erskine Creek, no encroachment was allowed because of hazardous velocities.

The Sandy Creek floodway was delineated coincidently with the 100-year flood plain boundary. Additional floodway data were not provided by the study contractor.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Kern County.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard. In riverine areas, reaches are based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the riverine reaches determined for the flooding source of Kern County are shown on the Flood Profile (Exhibit 1) and summarized in Table 5.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Boron Avenue Creek Reach 1	1645,1860	-1.1	-0.3	0.8	010	A2	Varies - See Map
Calvert Wash Shallow Flooding	0580,0590	N/A	N/A	N/A	N/A	AH	Varies - See Map
Claymine Road Shallow Flooding	1625,1650, 1850,1855	N/A	N/A	N/A	N/A	AH	Varies - See Map
Grapevine Canyon Creek							
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 1, Velocity 6
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 2, Velocity 6
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 2, Velocity 7
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 7
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 8
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 9

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

BORON AVENUE CREEK-CALVERT WASH-CLAYMINE ROAD-GRAPEVINE CANYON CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Grapevine Canyon Creek (Cont'd) Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 4, Velocity 9
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 4, Velocity 10
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 5, Velocity 10
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 5, Velocity 11
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 6, Velocity 12
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 7, Velocity 12

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

GRAPEVINE CANYON CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Indian Wells Canyon Creek Alluvial Fan Flooding	270,300, 560,580	N/A	N/A	N/A	N/A	A0	Depth 1, Velocity 4
Alluvial Fan Flooding	560,580	N/A	N/A	N/A	N/A	A0	Depth 1, Velocity 5
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 1, Velocity 6
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 2, Velocity 6
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 2, Velocity 7
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 7
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 8
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 9
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 4, Velocity 9

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

INDIAN WELLS CANYON CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Indian Wells Canyon Creek (Cont'd)							
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 4, Velocity 10
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 5, Velocity 10
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 5, Velocity 11
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 6, Velocity 11
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 6, Velocity 12
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 7, Velocity 12

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

INDIAN WELLS CANYON CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Indian Wells Canyon Creek (Cont'd) Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 7, Velocity 13
Alluvial Fan Flooding	560	N/A	N/A	N/A	N/A	A0	Depth 8, Velocity 13
Jawbone Canyon Wash Reach 1	1380	-3.0	-0.8	1.3	030	A6	Varies - See Map
Little Dixie Wash Reach 1	0580	-1.0	-0.1	1.1	010	A2	Varies - See Map
North El Paso Wash Shallow Flooding	0585,0580, 0590	N/A	N/A	N/A	N/A	AH	Varies - See Map
North Ridgecrest Wash Shallow Flooding	0585,0590	N/A	N/A	N/A	N/A	AH	Varies - See Map
Short Canyon Creek Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 2, Velocity 7

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

INDIAN WELLS CANYON CREEK-JAWBONE CANYON WASH-LITTLE DIXIE WASH-NORTH EL PASO WASH-NORTH RIDGECREST WASH-SHORT CANYON CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Short Canyon Creek (Cont'd) Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 7
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 8
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 3, Velocity 9
Alluvial Fan Flooding	270	N/A	N/A	N/A	N/A	A0	Depth 4, Velocity 9
South El Paso Wash Shallow Flooding	0580,0585, 0590	N/A	N/A	N/A	N/A	AH	Varies - See Map
South Ridgecrest Wash Shallow Flooding	0585,0590, 0595	N/A	N/A	N/A	N/A	AH	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SHORT CANYON CREEK-SOUTH EL PASO WASH-SOUTH RIDGECREST WASH

FLOODING SCURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Twenty Mule Team Creek							
Shallow Flooding	1855,1860	N/A	N/A	N/A	N/A	AH	Varies - See Map
Shallow Flooding	1860	N/A	N/A	N/A	N/A	A0	Depth 2

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

TWENTY MULE TEAM CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Erskine Creek							
Reach 1	0495	-13.7	-5.0	10.6	140	A24	Varies - See Map
Reach 2	0495	-7.3	-5.1	8.5	075	A15	Varies - See Map
Reach 3	0495	-4.5	-3.0	4.7	045	A9	Varies - See Map
Reach 4	0495,0515	-2.5	-1.4	1.8	025	A5	Varies - See Map
Reach 5	0495,0515	-0.9	-0.4	0.9	010	A2	Varies - See Map
Reach 6	0515	-2.4	-1.4	2.1	025	A5	Varies - See Map
Reach 7	0515	-4.2	-2.7	4.7	040	A8	Varies - See Map
Reach 8	0515	-6.1	-3.9	6.3	060	A12	Varies - See Map
Breckenridge							
Shallow Flooding	1010,1050	N/A	N/A	N/A	N/A	AH	Varies - See Map
Shallow Flooding	1010	N/A	N/A	N/A	N/A	A0	Depth 2
Kelso Creek							
Reach 1	0530,0540	-1.9	-0.8	1.9	020	A4	Varies - See Map
Shallow Flooding	0510,0530	N/A	N/A	N/A	N/A	A0	Depth 2

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

ERSKINE CREEK-BRECKENRIDGE-KELSO CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Kern River Near Bakersfield-With Consideration of Levees							
Reach 1	1000,1005, 1010,1015	-2.6	-1.0	3.5	025	A5	Varies - See Map
Reach 2	1010	-4.7	-1.7	4.8	045	A9	Varies - See Map
Reach 3	1010	-5.0	-1.8	11.1	050	A10	Varies - See Map
Reach 4	0745,1010	-3.9	-1.4	7.9	040	A8	Varies - See Map
Reach 5	0745,0765	-5.7	-1.9	2.7	055	A11	Varies - See Map
Reach 6	0765,0770	-4.6	-1.6	5.6	045	A9	Varies - See Map
Kern River Near Bakersfield-Without Consideration of Levees							
Reach 1	1005,1015	-1.6	-0.6	3.5	015	A3	Varies - See Map
Kern River at Kernville							
Reach 1	0205,0215	-7.0	-2.2	6.4	070	A14	Varies - See Map
Reach 2	0205	-6.4	-2.0	6.3	065	A13	Varies - See Map
South Fork, Kern River							
Reach 1	0510,0530	-3.0	-1.1	3.5	030	A6	Varies - See Map
Reach 2	0240,0530	-5.2	-2.0	5.9	050	A10	Varies - See Map
Reach 3	0240	-7.8	-2.6	5.8	080	A16	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

KERN RIVER NEAR BAKERSFIELD-WITH CONSIDERATION OF LEVEES-
KERN RIVER NEAR BAKERSFIELD-WITHOUT CONSIDERATION OF LEVEES-
KERN RIVER AT KERNVILLE-SOUTH FORK, KERN RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Cuddy Creek							
Reach 1	1930	-1.2	-0.4	0.8	010	A2	Varies - See Map
Reach 2	1930	-4.0	-1.7	3.4	040	A8	Varies - See Map
Reach 3	1910,1930	-3.3	-1.3	3.9	035	A7	Varies - See Map
Reach 4	1910	-3.1	-1.3	4.5	030	A6	Varies - See Map
Reach 5	1910	-4.4	-1.8	5.9	045	A9	Varies - See Map
Reach 6	1910	-5.5	-2.3	6.3	055	A11	Varies - See Map
Reach 7	1910	-3.7	-1.5	4.6	035	A7	Varies - See Map
Reach 8	1910	-7.4	-2.9	3.5	075	A15	Varies - See Map
Reach 9	1910	-3.1	-1.5	2.9	030	A6	Varies - See Map
Reach 10	1910	-4.6	-2.2	4.3	045	A9	Varies - See Map
Ranger Station Creek							
Reach 1	1910	-3.9	-1.0	2.8	040	A8	Varies - See Map
Upper Sycamore Creek							
Reach 1	1315	-5.3	-2.6	4.9	055	A11	Varies - See Map
Reach 2	1315	-2.1	-1.3	2.5	020	A4	Varies - See Map
Reach 3	1315	-1.1	-0.5	1.1	010	A2	Varies - See Map
Reach 4	1315,1530	-1.6	-0.9	1.8	015	A3	Varies - See Map
Reach 5	1530	-1.0	-0.5	0.7	010	A2	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

CUDDY CREEK-RANGER STATION CREEK-UPPER SYCAMORE CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Antelope Creek							
Reach 1	1555	-6.1	-2.1	4.5	060	A12	Varies - See Map
Reach 2	1555	-3.7	-1.2	2.7	035	A7	Varies - See Map
Reach 3	1555	-1.4	-0.3	1.1	015	A3	Varies - See Map
Blackburn Creek							
Reach 1	1555	-2.5	-0.7	1.9	025	A5	Varies - See Map
Shallow Flooding	1555	N/A	N/A	N/A	N/A	AH	Varies - See Map
Caliente Creek							
Shallow Flooding	1045,1285	N/A	N/A	N/A	N/A	AH	Varies - See Map
Shallow Flooding	1020,1050, 1275,1285, 1300	N/A	N/A	N/A	N/A	A0	Depth 1
Reach 1	1065	-17.4	-8.8	0.1	170	A27	Varies - See Map
Reach 2	1065,1305	-7.0	-3.4	7.2	070	A14	Varies - See Map
Reach 3	1065,1305	-5.5	-2.9	7.5	055	A11	Varies - See Map
Reach 4	1065,1305	-4.7	-2.1	3.5	045	A9	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

ANTELOPE CREEK-BLACKBURN CREEK-CALIENTE CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Poso Creek							
Reach 1	0420	-1.6	-0.0	0.0	015	A3	Varies - See Map
Reach 2	0420	-1.1	-0.2	0.2	010	A2	Varies - See Map
Reach 3	0420	-1.6	-0.2	0.2	015	A3	Varies - See Map
Reach 4	0420,0710	0.2	0.4	0.1	005	A1	Varies - See Map
Reach 5	0420,0710	-1.0	-0.1	0.1	010	A2	Varies - See Map
Reach 6	0420,0710 0730	-3.3	-0.8	2.0	035	A7	Varies - See Map
Reach 7	0730	-4.8	-1.5	3.4	050	A10	Varies - See Map
Sandy Creek							
Reach 1	1430	-2.9	-0.9	1.5	030	A6	Varies - See Map
Reach 2	1430	-1.5	-0.6	1.3	015	A3	Varies - See Map
South Branch Poso Creek Reach 1	0420,0710	-2.6	-0.7	1.8	025	A5	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KERN COUNTY, CA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

POSO CREEK-SANDY CREEK-SOUTH BRANCH POSO CREEK

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone A0:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no FHFs are determined.
Zone AH:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; base flood elevations are shown, but no FHFs are determined.
Zones A1-A16, A24, and A27:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flood hazard; not subdivided.
Zone D:	Areas of undetermined, but possible flood hazard.

Alluvial fan flood hazard areas are shown on the Flood Insurance Rate Map (published separately) as Zone A0, with average depths and velocities of flow given. In these areas, 100-year flood depths may exceed 3 feet. Development of alluvial fans is subject to a

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more severe flood hazard than would normally be encountered in Zone AO. This is the result of high velocities and the unpredictability of the location of the stream channel across the width of the fan.

The flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 5.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Kern County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

6.0 OTHER STUDIES

Flood Insurance Studies and/or Flood Insurance Rate Maps have been prepared for the following communities: City of California City (Reference 36); Inyo County (Reference 37); Los Angeles County (Reference 38); City of Maricopa (Reference 39); City of McFarland (Reference 40); City of Ridgecrest (Reference 41); San Bernardino County (Reference 42); San Luis Obispo County (Reference 43); Santa Barbara County (Reference 44); City of Taft (Reference 45); and Ventura County (Reference 46). The results of those studies agree with the results of this study.

The following Flood Hazard Boundary Maps have been prepared, and are in agreement, with this study: Kings County (Reference 47); City of Shafter (Reference 48); and City of Wasco (Reference 49).

The flood plain boundaries for this study and the Flood Insurance Study for Tulare County (Reference 50) do not agree. The data prepared for Tulare County did not extend into Kern County. Flood plain boundary discrepancies do exist between the City of Bakersfield (Reference 51) and Kern County because of discrepancies in the scope of study. The zone designations within the City of Tehachapi (Reference 52) do not match this study. This disagreement was discussed with and approved by FEMA.

A Flood Hazard Boundary Map was previously published for the unincorporated areas of Kern County (Reference 35). This study represents a more detailed analysis, and therefore supersedes the previous map.

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7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Building 105, Presidio of San Francisco, San Francisco, California 94129.

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